



Instruction Manual for Table Top Centrifuge Z 400

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1 PRODUCT DESCRIPTION

1.1 Usage in accordance with safety standards

1.1.1 General information

1.1.1.1 Hazards and precautions

Before setting the centrifuge into operation, please read this instruction manual carefully!

This centrifuge must not be operated by unqualified personnel not being familiar with the correct use of the unit.

Always, use the original accessories only!

For your personal safety, please pay attention to following precautions:

- The **HERMLE Z 400** is not explosion-proof and must therefore not be operated in explosion-endangered areas or locations. During centrifugation, it is prohibited to stay within the safety zone of 30 cm around the centrifuge or deposit hazardous substances within this area.
- Centrifugation of flammable, explosive and radioactive substances or substances, which chemically react with high energy, is strictly prohibited!
- Never spin toxic or pathogenic material without adequate safety precautions, i.e. centrifugation of buckets / tubes without or with defective hermetic sealings is strictly prohibited.
The user is obligated to perform appropriate disinfection procedures in case dangerous substances have contaminated the centrifuge and / or its accessories. When centrifuging infectious substances, always pay attention to the General Laboratory Precautions. If necessary, contact your safety officer!
- It is prohibited to run the centrifuge with rotors other than listed for this unit.
- Under no circumstances open the lid of the centrifuge while the rotor is still running or rotating with a speed of > 2 m/s.

Following rules must strictly be adhered to:

- Do not operate the centrifuge in case it is not installed correctly.
- Do not operate the centrifuge when dismantled (e.g. without metal cover).
- Do not run the centrifuge when mechanical or electrical assembly groups have been tampered with by unauthorized persons.
- Do not use accessories such as rotors and buckets, which are not exclusively approved by HERMLE Labortechnik GmbH, except commercially available centrifuge tubes made of glass or plastic.
- Do not spin extremely corrosive substances, as they may cause material damages and impair mechanical resistance.
- Do not operate the centrifuge with rotors or buckets, which show any signs of corrosion or mechanical damage.

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The manufacturer is responsible for safety and reliability of the centrifuge, only if:

- the unit is operated in accordance with this instruction manual.
- modifications, repairs or other adjustments are performed by HERMLE-authorized personnel and the electrical installation of the related location corresponds to the IEC-regulations.

1.1.1.2 Brief description

Model **Z 400** is a table top centrifuge. Various rotors are available for this unit. Speed / RCF-value and running time can easily be set with turning knobs and are displayed on large LED's.

The pre-set run parameters are stored after the end of each run.

The lid is latched and released with an electromagnetic lid lock.

The centrifuge has a maintenance-free brushless induction drive with a low noise level.

1.1.1.3 Safety standards

The centrifuge corresponds with the General Requirements for Medical Units Regulations (MedGV) (group 3).

Following standards have been considered for the production of our centrifuges:

- Accident Prevention Regulation for electrical units and installations UVV VBG 4
- Accident Prevention Regulation for centrifuges as per UVV VBG 7 z
- DIN 58970 part 1, 2 and 4 for centrifuges and tubes
- Electrical Interference Suppression according to interference degree B as per VDE 0871
- Electrical Safety as per IEC 1010-1 and IEC 1010-2-D
- European Standard PR EN 61 010-1 and PR EN 61 010-2-2

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1.1.1.4 Extent of supply

Following parts are supplied as accessories with each centrifuge:

- 2 fine-wire fuses 4,0 AT (230 V)
- 2 fine-wire fuses 6,3 AT (120 V)
- 1 instruction manual
- 1 Allan key for removing rotors

Spare fuses are behind the control panel inside of the centrifuge.

1.1.1.5 Warranty

The centrifuge has been subjected to thorough testing and quality controls.

In the unlikely case of any manufacturing faults occurring, the centrifuge and rotors are covered by warranty for a period of one year from date of delivery.

This warranty becomes invalid in case of mishandling, damage and negligence and further in case of usage of inappropriate spare parts and / or accessories or unauthorized modification of the unit.

Technical modification rights are reserved by the manufacturer in respect to technical improvement.

1.2 Installation

1.2.1 Installation of the centrifuge

1.2.1.1 Unpacking the centrifuge

Model **Z 400** is supplied in a carton.

Remove the strap retainer, open the carton, remove the cover carton and the centrifuge. The instruction manual must always be kept with the centrifuge.

1.2.1.2 Space requirements

The centrifuge should be installed on an even and solid surface, if possible on a laboratory cabinet / table or some other solid vibration free surface.

In order to enable a safe and smooth operation, level the centrifuge with a spirit level.

The centrifuge must be placed in a way, that there is a minimum space of 30 cm on each side of the unit in order to ensure necessary heat dissipation.

Do not place the centrifuge next to a window or a heater, where it could be disposed to excessive heat.

Safety regulations require that the safety area of 30 cm around the unit is marked in order to indicate that neither hazardous substances nor persons should be within this area during centrifugation.

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1.2.1.3 Installation

Follow these steps:

- Check whether power supply corresponds with the one named on the manufacturer's rating label which is mounted on the rear panel.
- The line voltage circuit breaker is max. 16 A (type K) slow release for commonly used instruments.
- In case of emergency, there must be an emergency switch off installed outside the room in order to disconnect the power supply of the unit.
- Remove the transport spacer blocks from the motor shaft (see chapter 2.2.2).

The socket for the power cord must be easy to reach respectively easy to disconnect!

1.3 Technische Daten

Manufacturer	HERMLE Labortechnik GmbH	
Type / Model	Z 400	
Dimensions		
Width	43 cm	
Depth	54 cm	
Height	36,5 cm	
Weight	39 kg	
Noise level (max.)	60 +2,0 dB (A)	
Max. speed	13.500 min ⁻¹	
Max. volume	4 x 250 ml	
Max. RCF	17.523 x g	
Admissible density	1,2 kg/dm ³	
Admissible kinetic energy	4.000 Nm	
Electrical connection AC	230 V / 50 Hz 1 ph	120 V / 60 Hz 1 ph
Current	3,8 A	4,0 A
Connected load	650 Watt	480 Watt
Interference suppression	VDE 0871, Funkentstörgrad B	
Test obligations	yes	
To be filled in by purchaser:		
Inventory-No.:	<div></div>	
Check-No.:	<div></div>	
Location:	<div></div>	
Maintenance contract:	<div></div>	
Your service department	HERMLE Labortechnik GmbH Gosheimer Str. 56 78564 Wehingen Tel.: 07426 / 96 22-17	
Your agent	<div></div>	

1 PRODUCT DESCRIPTION

1.4 Conformity declaration

as per annex II A of the European Authorities' Standards for machines (89/392/EWG)

We, the company

HERMLE Labortechnik GmbH
Gosheimer Str. 56
78564 Wehingen

declare in mere responsibility, that our product

centrifuges

of models

Z 160 M
Z 200 A
Z 233 M-2; Z 233 MK-2
Z 300; Z 300 K; Sieva -2
Z 323; Z 323 K; Z 383; Z 3838 K
Z 400; Z 400 K; Z 513; Z 513 K
ZK 404

as from month / year of construction 08 / 00

to which this declaration refers to, have been manufactured according to the following standards or normative documents:

- DIN EN 61 010-1; DIN EN 61 010-2-020
- IEC 66 E (CO) 11; IEC 335-1
- EN 55022
- 89/392/EWG; 91/368/EWG; 92/31/EWG
- 93/42/EWG; 89/336/EWG; 73/23/EWG
- VDE 0871 (B)



Wehingen, 1. November 1998

Harald Hermle
General Manager

2 OPERATION

2.1 Installation of rotors

2.2.1 Mounting and loading angle rotors

Clean the motor shaft as well as the rotor mounting boring with a clean, grease-free piece of cloth. Place the rotor onto the motor shaft, ensuring that the pin aligns correctly with the rotor slot (see Figures 1 and 2).

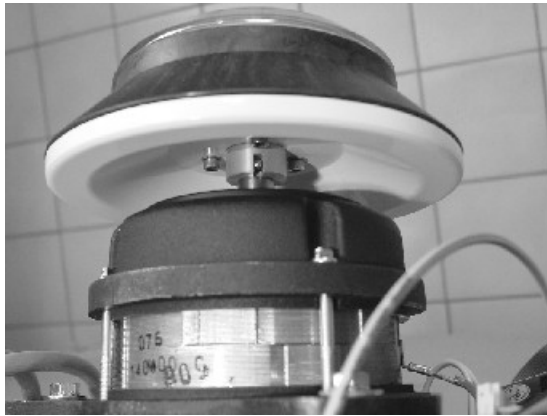


Figure 1: correct

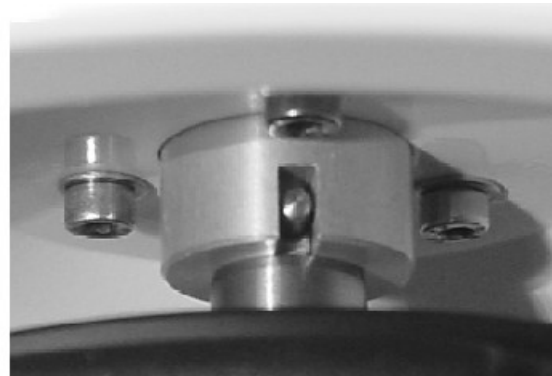
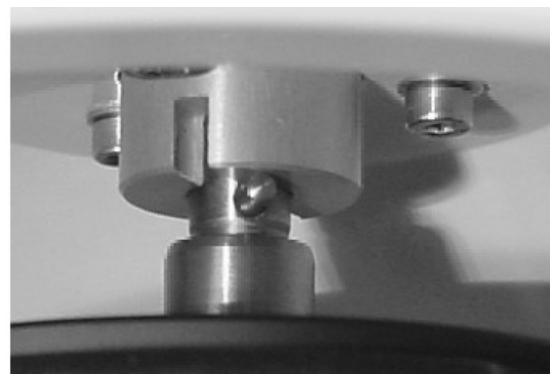


Figure 2: wrong



2 OPERATION

Hold the rotor with one hand and secure the rotor to the shaft by turning the rotor nut (1) counter-clockwise. Tighten rotor nut with enclosed allen key (see Figure 3).



Figure 3

It is allowed to operate e.g. a 8-place-rotor with 2 or 4 loaded tubes only. But the loaded borings must be opposite each other.

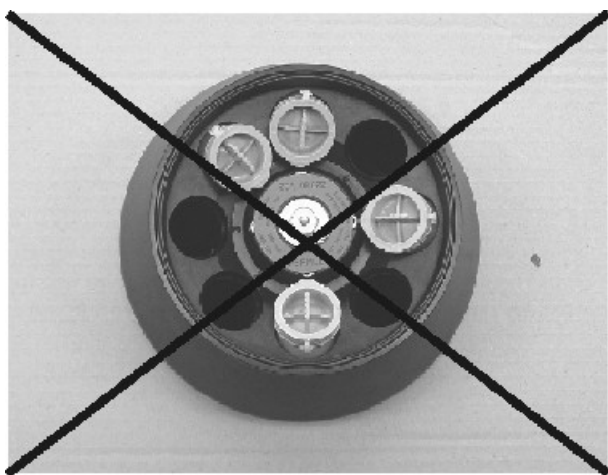


Figure 4: wrong

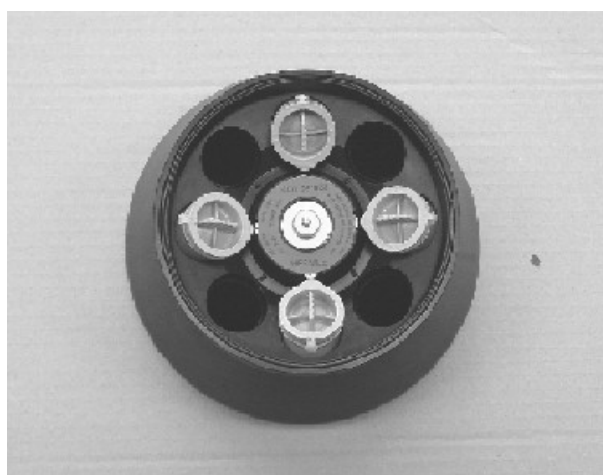


Figure 5: correct

2 OPERATION

ATTENTION:

Before operation, secure the rotor lid to the rotor by pressing the snap connector lightly onto the rotor nut. Take care the lid is correctly placed into the guide.



Figure 6

2.1.2 Mounting and loading swing out rotors

Clean the motor shaft, as well as the device hole of the rotor with a clean and fat free cloth. Put the rotor to the motor shaft (take care that the cross pin is sitting right to the driving disk of the rotor) (s. Figure 1 and Figure 2).

Hold the rotor with one hand and secure the rotor to the shaft by turning the rotor nut (1) counter-clockwise. Tighten rotor nut with enclosed allen key (see Figure 3).

The charging of the buckets and the adapters must be done appropriately figure 7 and figure 8.

In principle swing out rotors may be taken in operation first if all buckets or racks are put into the rotor.

The bolts at the rotor must be easily greased with silicone grease.

The glasses have to be filled evenly by eye and put into the drillings or tube racks. The weight difference of the loaded buckets should not exceed approx. 1.0 g.

It is allowed to operate e.g. a 4-place-rotor with 2 loaded tubes only. But the loaded borings must be opposite to each other. Make sure that the unloaded buckets also be put inside the rotor (see Figure 7 and 8).

2 OPERATION



Figure 7: wrong



Figure 8: right

2.1.3 Overloading of rotors

The maximum load permitted for a rotor, which is determined by the manufacturer, as well as the maximum speed allowed for this rotor (see label on rotor), must not be exceeded.

The liquids the rotors are loaded with, should have an average homogeneous density of 1,2 g/ml or less when the rotor is running at maximum speed.

In order to spin liquids with a higher density, the speed has to be reduced according to the following formula:

$$\text{Reduced speed } n_{\text{red}} = \sqrt{\frac{1,2}{\text{higher density}}} \times \text{max. speed } (n_{\text{max}}) \text{ of the rotor}$$

Example:

$$n_{\text{red}} = \sqrt{\frac{1,2}{1,7}} \times 4.000 = 3.360 \text{ rpm}$$

In case of any questions, please contact the manufacturer!

2.1.4 Removing the rotor

Take off the lid of the rotor. Hold the rotor with one hand. Loosen the rotor nut with the included allen key by turning it clockwise.

ATTENTION:

Do not operate the centrifuge with rotors or buckets which show any signs of corrosion or mechanical damage.

Do not operate with extremely corrosive substances which could damage the rotor and buckets.

2 OPERATION

2.2 Operation

2.2.1 Power switch


The centrifuge has no power switch.


You can connect the unit by plug in the main plug or disconnect it by unplugging.

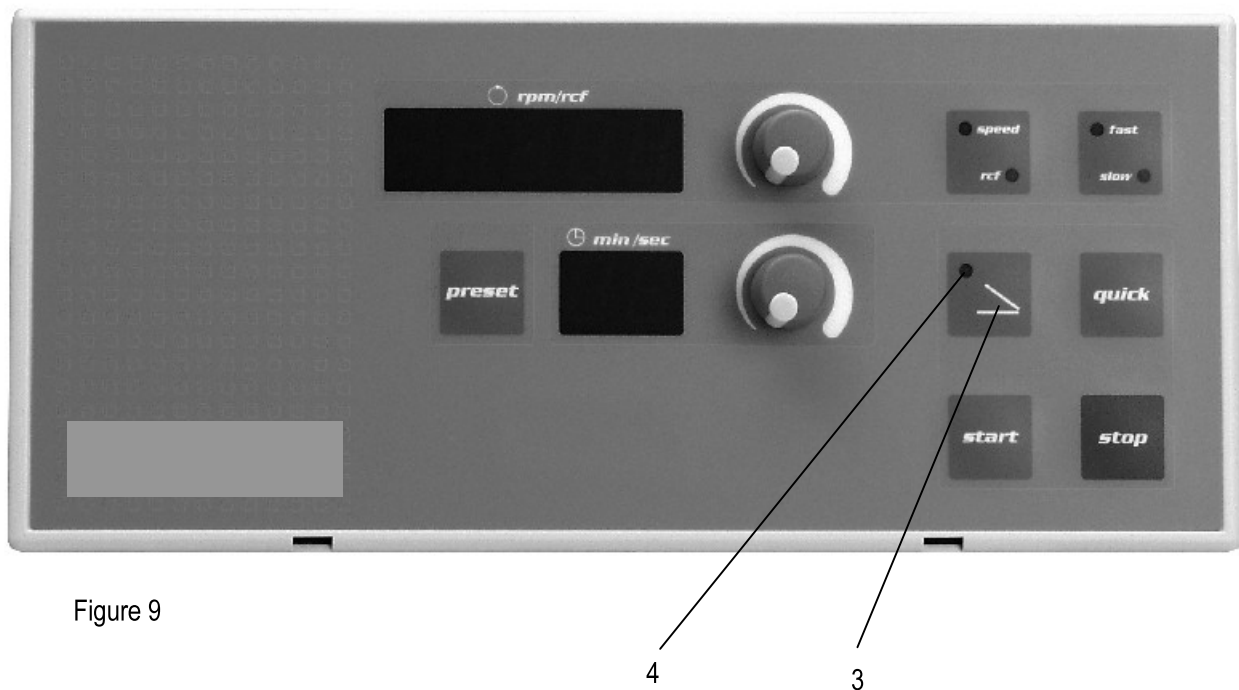
The Centrifuge has a stand-by function, i. e. is the Centrifuge for 3-4 min. not in use or no button is pressed, the digital displays will switch off.

If now one of the buttons or knobs are actuated, the display will hook up again.

2.2.2 Lid release

When the green control lamp on the key  is flashing, the rotor is standing still and the lid of the centrifuge is ready to open.


Press the key  (3) (see Figure 8), in order to open the lid. The green control lamp (4) turns off, as soon as the lid opens or the centrifuge starts.



2.2.3 Lid lock

After mounting and loading the rotor correctly, the lid of the centrifuge can be closed.

The centrifuge can only be started when the lid is closed correctly.

The green control lamp of the key  will flash as soon as the lid is closed correctly.

When the rotor starts acceleration, the control lamp will turn off and the lid will be impossible to open.

In case the green control lamp is still flashing after pressing the "START" key, you have to open the lid again. This safety feature shows, that a run is already finished. When the lid of the centrifuge is closed, the display will switch from **preset** to **actual** value. In order to check preset speed / RCF-value, running time and temperature press key "PRESET".

2 OPERATION

2.2.4 Pre-selection of speed / RCF-value

When the lid of the centrifuge is open, you can preset the requested speed or RCF-value by turning the speed potentiometer (5).

With the key "SPEED/RCF" (6) you can switch between speed and RCF-value to be shown in the display. The green control lamps (7) indicate, which mode is activated.

When the lid of the centrifuge is closed or during a run, speed can be changed as follows:

Press the "PRESET" key (8), hold it and at the same time turn the speed / RCF potentiometer (5) to change the value.

Maximum speed of this unit is 13.500 rpm.

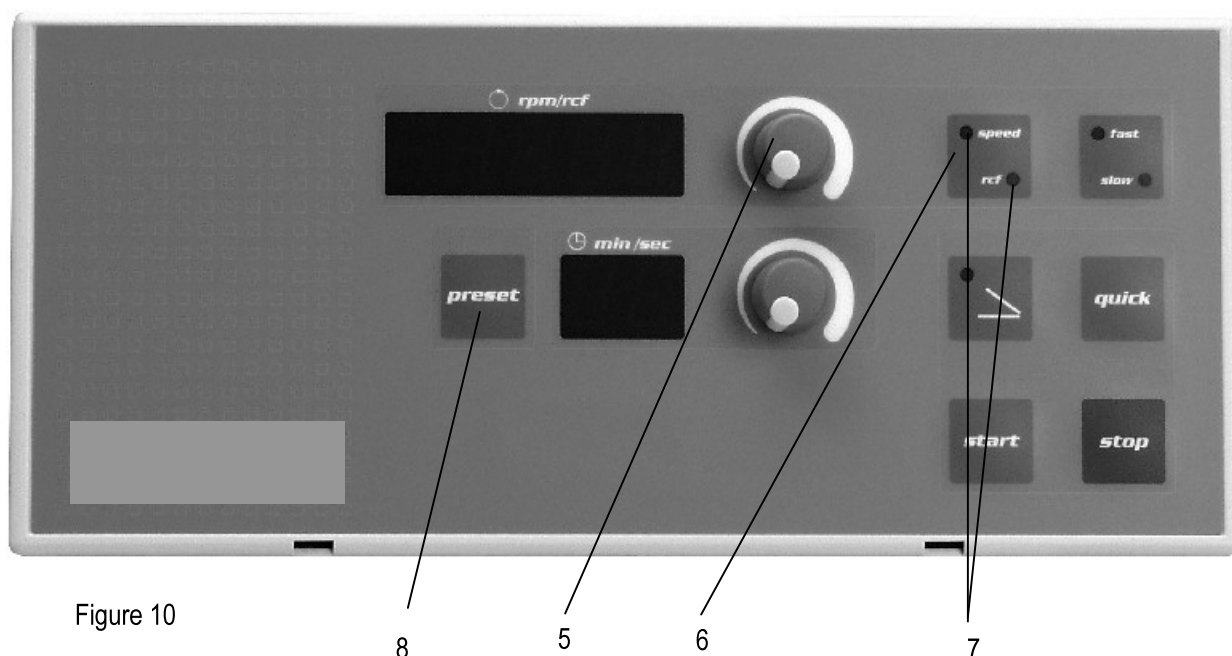


Figure 10

Max. Revolution per minutes of the valid rotors Z 400 and Z 400 K

Rotor-Number	Max. revolution
220.86 V01	3500 min ⁻¹
221.08 V01	3500 min ⁻¹
220.93 V01	3500 min ⁻¹
221.02 V01	4000 min ⁻¹
221.03 V01	4000 min ⁻¹
220.27 V02	3500 min ⁻¹
220.87 V03/04	13500 min ⁻¹
220.97 V02	6000 min ⁻¹
220.96 V02	6000 min ⁻¹
220.50 V06	3500 min ⁻¹
220.88 V01	13500 min ⁻¹
220.92 V01	13500 min ⁻¹
220.81 V01	3500 min ⁻¹
221.16 V01	4500 min ⁻¹

2 OPERATION

2.2.5 Pre-selection of running time

Running time is adjustable from 1 to 60 min. or continuous.

When the lid of the centrifuge is open, running time can be preset with the "TIME" potentiometer (9) in increments of 1 minute. During the run or when the lid is closed you have to additionally press the key "PRESET" (10) in order to change running time values.

The preset running time will be shown in the display (11) in minutes. The preset running time will be stored after the run. When the lid of the centrifuge is closed, the running time display will switch from preset to actual value.

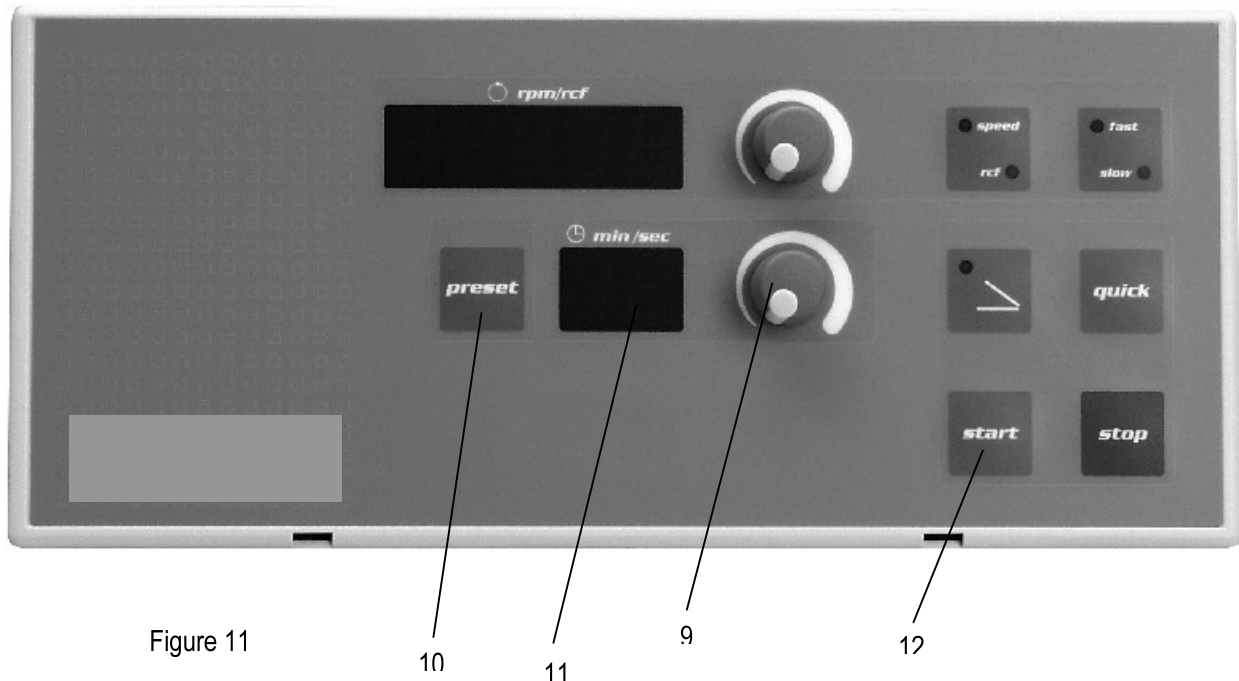


Figure 11

For continuous run, turn the time potentiometer (9) clockwise to the limit stop. The display (11) indicates **continuous run** with two dashes "- -".

During continuous run, the running time passed can be read off as follows:

- Press key "START" (12).
Afterwards, running time is shown in display (11) in following steps:
- First, there is symbol "h" for hours, and then the number of hours will be shown.
Afterwards, there is symbol "m" for minutes, and then the number of minutes will be shown.

2 OPERATION

Example: 1 hour 47 minutes running time passed

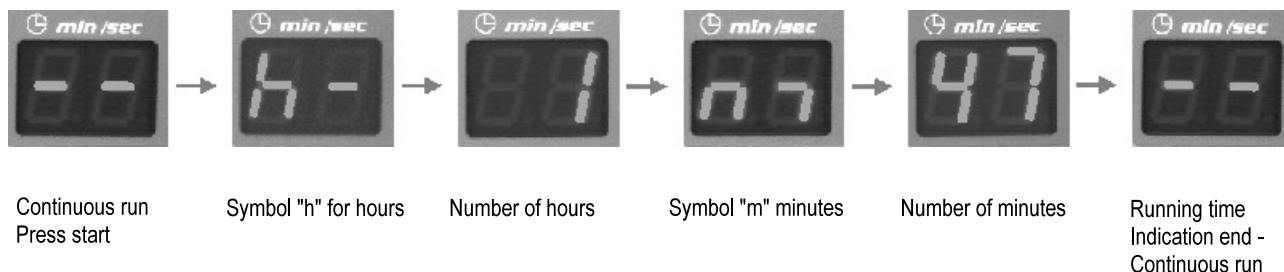


Figure 12

ATTENTION:

In order to check the running time passed the unit must already be running for at least one minute.

A run in continuous mode can only be finished by pressing key "STOP".

2.2.6 Pre-selection of brake intensity and acceleration

With the key "FAST / SLOW" (13) you can choose between two profiles for brake and acceleration intensity.



Figure 13

Acceleration- and deceleration times Z 400 and Z 400 K (120 V / 230 V) in seconds

Rotor-number	Acceleration values		Deceleration values	
	fast	slow	fast	slow
220.86 V01	45	103	51	97
221.08 V01	67	120	58	110
220.93 V01	45	105	50	100
221.02 V01	30	60	40	60
221.03 V01	30	65	30	60
220.27 V02	45	120	52	100
220.87 V03/04	23	77	32	124
220.97 V02	23	49	26	60
220.96 V02	27	63	40	115
220.50 V06	30	60	30	77
220.88 V01	28	37	33	57
220.92 V01	25	37	30	57
220.81 V01	25	37	30	57
221.16 V01				

2 OPERATION

When control lamp "FAST" is flashing, the unit accelerates and brakes fast. When control lamp "SLOW" is flashing, the unit accelerates and brakes slowly and gently below 2.000 rpm.

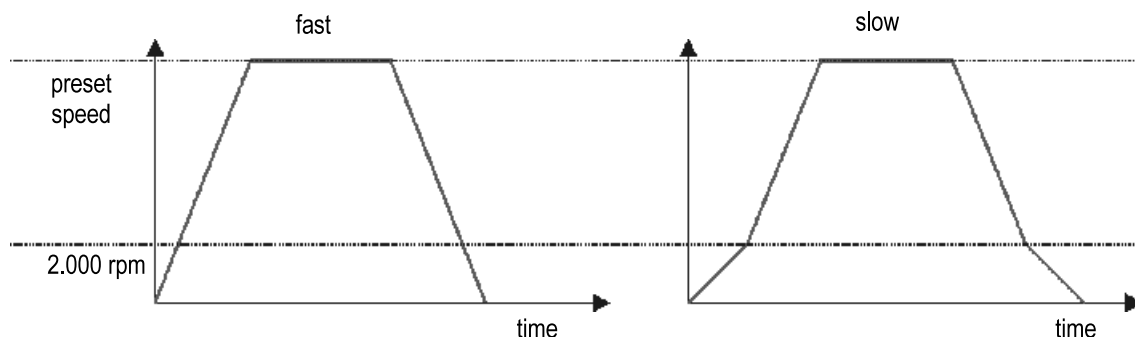


Figure 14

2.2.7 Keyboard – Starting the centrifuge – "QUICK"-key

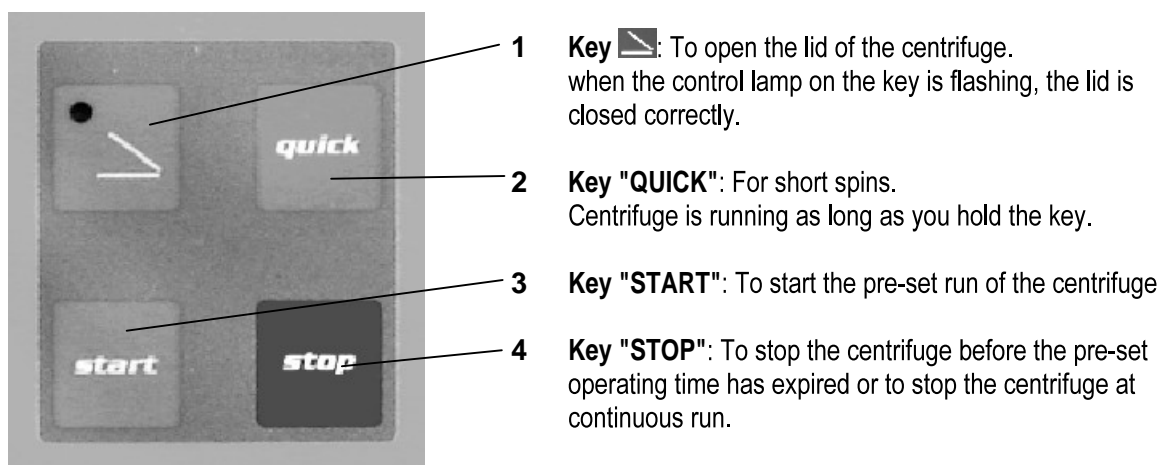



Figure 16

Starting the centrifuge

Insert a correctly and fully loaded rotor and tighten it to the motor shaft. Close the lid of the centrifuge. as soon as the control lamp at the key  is flashing, the centrifuge run can be started. Therefore, press key "START".

ATTENTION: The rotor has to be checked and / or tightened previous to each run!

"QUICK"-key – short runs

For short centrifuge runs you can start the run with key "QUICK". Press the key "QUICK". The centrifuge starts and runs as long as you hold the key "QUICK". The running time is shown in the display "TIME" in seconds.

2.3 Safety features

2.3.1 Imbalance detection

In case of the rotor not being equally loaded (see chapter 2.1.1), the drive will turn off during acceleration. The rotor decelerates to stand still.

When error message "1" appears in the actual "SPEED" display, the weight difference of the samples is too huge. Weigh out the samples exactly.
Load the rotor as described in chapter 2.1.1.

When error message "2" appears in the actual "SPEED" display, there could be following reasons:

- The imbalance switch is not correctly adjusted.
- The imbalance switch is defective.

3.1 Service and maintenance

3.1.1 Maintenance and cleaning

Maintenance:

Maintenance of the centrifuge is confined to keeping the rotor, the rotor chamber and the rotor accessories clean as well as to regularly lubricating the rotor insert bolts of a swing out rotor (if available).

Vaseline, available in nearly each store, is the most suitable lubricant. The Vaseline must be free of resin and acids. Lubricants containing molybdate and graphite are not allowed.

Please pay special attention to anodized aluminium parts. Breakage of rotors can be caused even by slightest damages.

In case of rotors, buckets or tube racks getting in touch with corrosive substances the concerned spots have to be cleaned carefully.

Corrosive substances are for instance:

- Alkalies
- Alkaline soap solutions
- Alkaline amines
- Concentrated acids
- Solutions containing heavy metals
- Water-free chlorinated solvents
- Saline solutions, e.g. salt water

Cleaning:

Thorough cleaning not only has its purpose in hygiene but also in avoiding corrosion based on pollution.

In order to avoid damaging anodized parts such as rotors, reduction plates etc., only pH-neutral detergents with a pH-value of 6-8 may be used for cleaning. Alkaline cleaning agents (pH-value > 8) must not be used.

After cleaning, please ensure all parts are dried thoroughly, either by hand or in a hot-air cabinet (max. temperature + 50°C).

It is necessary to coat anodized aluminium parts with anti-corrosion oil regularly in order to increase their life-spans and reduce corrosion predisposition.

Due to humidity or not hermetically sealed samples, condensate may be formed. The condensate has to be removed from the rotor chamber with a soft cloth regularly.

The maintenance procedure has to be repeated every 10 to 15 runs, but at least once a week.

3 MAINTENANCE

3.1.2 Glass breakage

With high g-values, the rate of glass tube breakage increases. Glass splinters have to be removed immediately from rotor, buckets, adapters and the rotor chamber itself. Fine glass splinters will scratch and therefore damage the protective surface coating of a rotor.

If glass splinters remain in the rotor chamber, fine metal dust will build up due to air circulation. This very fine, black metal dust will extremely pollute the rotor chamber, the rotor, the buckets and the samples.

3.1.3 Disinfection

In case of infectious material spilling into the centrifuge, the rotor and rotor chamber have to be disinfected right after the run. Rotors may be autoclaved at a maximum temperature of 121°C, except rotor 220.58 V08, which must not be autoclaved.

The rotor and rotor chamber should be cleaned with a universal, neutral disinfection agent, e.g. on formalin base. A disinfection spray is most suitable in order to easily reach all difficult to access spots.

ATTENTION:

Before applying any other cleaning resp. decontamination method than recommended by the manufacturer, contact the manufacturer to ensure yourself, you would not damage the unit or the rotor by applying the designated method!

4 TROUBLE SHOOTING

4.1 Error messages: cause / solution

Preface:

The error messages are listed to help localize possible errors faster.

The diagnose referred to in this chapter may not always be the case, as they are only theoretically occurring errors and solutions.

Always, please keep us informed about any kind of error occurring, which is not listed in this chapter. Only through your information we are able to improve and complete this instruction manual.

Many thanks in advance for your support.

HERMLE Labortechnik GmbH

4.2 Survey of possible error messages and their solutions

4.2.1 Lid release during power failure (Emergency Lid Release)

In case of power failure or malfunction, the lid of the centrifuge can be opened manually in order to protect your samples.

Please proceed as follows:

- Switch the centrifuge off and unplug the power cord.
- At the left side of the centrifuge housing there is a plastic plug tightened to a cord.
- Pull the plastic plug out of the housing and pull the cord to open the lid of the centrifuge (see Figure 18).

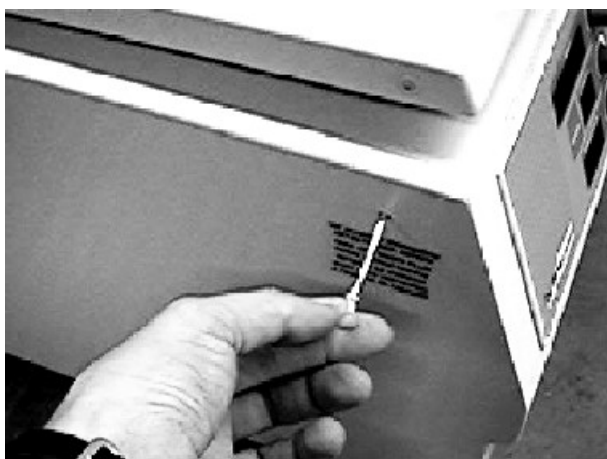


Figure 18

4 TROUBLE SHOOTING

4.2.2 Description of the error message system

The error message is shown in the "SPEED" display through particular figures (see Figure 18).

There is a distinction between two different kinds of errors.

The digits in the "SPEED" display have the following meaning:

- **Error No. 1 – 49 (forced stop)**

In case of one of these errors occurring, the rotor decelerates from pre-set speed down to 0. As soon as the rotor stops, the error message can be reset by opening and closing the lid of the centrifuge.

- **Error No. 50 – 99 (emergency stop)**

In case one of these errors occurring, the frequency converter switches off. This means, the rotor stops without applying the brakes. To reset the error message you have to switch off the unit and turn it on again (power switch).

In case the unit stops due to an error indication, you should restart the unit to check whether the error occurs again.

The error message figures not listed in this chapter are currently not in use. They are reserved for future use in completing the error message recognition program.

Example: figures are flashing

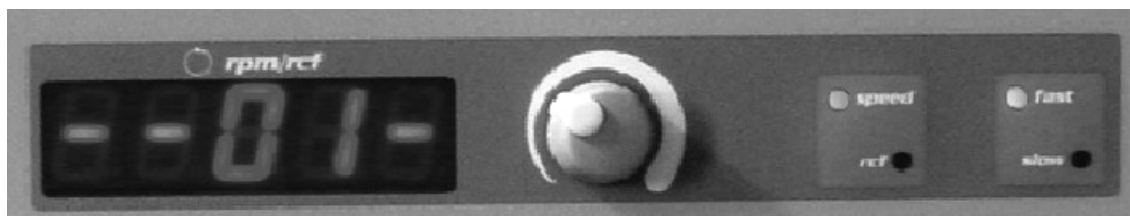


Figure 19

4.2.3 Error messages

Error No. 1: Imbalance

- Cause: Incorrect loading of the rotor (see chapter 2.2.1)
- Solution: Balance your samples

- Cause: Incorrect adjustment of the imbalance sensor
- Solution: Imbalance sensor has to be re-adjusted (call service department)

4 TROUBLE SHOOTING

Error No. 2: Permanent imbalance signal

- Cause: Incorrect position of the imbalance sensor
- Solution: Imbalance sensor has to be readjusted (call service department)
- Cause: Imbalance sensor is defective
- Solution: Imbalance sensor has to be replaced (call service department)

Error No. 11: Temperature sensor is defective

- Cause: Temperature sensor is defective
- Solution: Call service department. Temperature sensor has to be changed.

Error No. 25: Power failure

- Cause: Power failure while rotor was in motion
- Solution: Open and close the lid of the centrifuge, restart the unit; check contact of plug in (loose contact)

Error No. 36: Relay of the frequency converter cannot be released / lid cannot be opened

- Cause: Power board malfunction
- Solution: Call service department
- Cause: Lid of the centrifuge is jammed
- Solution: Open the lid of the centrifuge manually when rotor is at stand still. Grease the lid lock slightly. In case this error occurs again, call service department; check coil of lid lock
- Cause: Lid lock is defective
- Solution: Call service department, replace lid lock
- Cause: Speed sensor wire is cutted
- Solution: Call service department, replace speed sensor wire

Error No. 50 / 51: Memory failure

- Cause: Internal or external memory failure
- Solution: Restart the unit. In case this error occurs again, call service department; replace control panel

Error No. 54: Wrong configuration

- Cause: Jumper is placed at the wrong position on control panel
- Solution: Re-place jumper

4 TROUBLE SHOOTING

Error No. 55: Over speed

- Cause: Speed sensor is defective
- Solution: Restart the unit. In case this error occurs again, call service department.
possibly loose speed magnet, fix with super glue

Error No. 60: Engine speed sensor signal is missing

- Cause: Speed sensor is defective or cable breakage at speed sensor, possibly lose magnet
- Solution: Call service department; check speed magnet, fix with super glue

Error No. 82: Cut off power board –frequency converter

- Cause: Over current or under voltage due to power supply fluctuations
- Solution: Restart the unit, take care the power supply is stable

Error No. 83: Preset speed cannot be reached

- Cause: Preset speed cannot be reached
- Solution: Call service department

Error No. 84: Over temperature frequency converter

- Cause: Frequency converter cut off due to over temperature
- Solution: Take care, there is enough space around the centrifuge for heat dissipation

Error No. 85: Over temperature motor

- Cause: Temperature protection switch of motor turns off
- Solution: Take care, there is enough space around the centrifuge for heat dissipation.
Motor mounting is defective, replace motor

Error No. 90: Emergency switch off lid lock

- Cause: The lid of the centrifuge has been opened while centrifuge was running
- Solution: Close the lid of the centrifuge. DANGER OF ACCIDENT!
- Cause: Control switch of lid lock is defective
- Solution: Call service department